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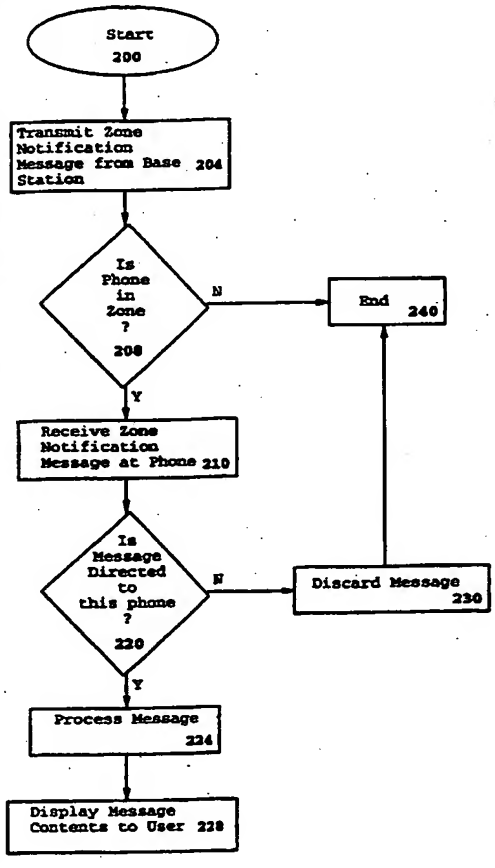
(54) Title: SYSTEM AND METHOD FOR IDENTIFYING USER ZONE USING BROADCAST ADDRESSED NOTIFICATION MESSAGES



(57) Abstract: A system and method for providing zone specific information to the user of a wireless terminal, e.g. a phone. Zone specific information is periodically transmitted (204) to users over a common overhead link using an available messaging format. If the phone is located within the zone, it will receive the information (208, 210). If the information is directed to that phone (220), the phone will process the information (224) and display information to the user (228). If the information is not directed to that phone (220), the information is discarded (230). An example of an implementation in a CDMA wireless phone system is to provide zone specific information using the Feature Notification Message broadcast over the Paging Channel of a particular zone. The information is provided using broadcast addressing. Broadcast of the zone specific information over the Paging Channel using the Feature Notification Message results in a reduction in the number of Access Channel registration messages required of mobile phones. A second embodiment uses broadcast addressing in conjunction with Short Message Services (SMS) to provide zone specific information. Broadcast addressing is advantageous in that zone specific information can be sent to subsets of wireless terminals. This allows broadcast in the same zone of a variety of zone specific information that targets different wireless terminals.

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SYSTEM AND METHOD FOR IDENTIFYING USER ZONE USING BROADCAST ADDRESSED NOTIFICATION MESSAGES

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention relates to wireless communications. More particularly, the present invention relates to a novel and improved system and method for using broadcast addressed feature notification messages to notify a wireless device user of the zone that they currently are in.

II. Description of the Related Art

In a wireless communication system, such as a cellular or Personal Communications Services (PCS) phone system, the system is physically divided into numerous coverage areas. Coverage areas may be defined by both physical and non-physical constraints. A coverage area defined by identity of service provider is an example of a non-physical constraint, whereas the coverage area defined by a single base station transceiver (i.e. a cell) is physically constrained by geography, transmitter power, and receiver sensitivity. A service provider divides its service area into numerous smaller zones. Each zone encompasses at a minimum the cell defined by a single base station transceiver and likely encompasses a number of cells. The size of each zone is defined by the service provider at the time of system design.

Coverage areas defined by the identity of the service provider are important for billing purposes. The service provider that assigns a telephone number and provides billing to a particular wireless device is designated the home service provider for that device. When a wireless device is used outside of its service provider's coverage area it is considered to be roaming. The cost of a roaming phone call is typically higher than the cost of a phone call within the home service provider's system. Because of the cost differential between home and roaming calls a wireless device uses

overhead information transmitted from the base station to the wireless device to inform the user when the phone is in a roaming condition. The wireless device typically provides an indicator on a phone display to inform the user of the roaming condition.

The same home/roaming concept can be used within a service provider's coverage area. The division of service provider coverage areas into distinct zones provides for the opportunity for the service provider to offer zone based progressive rate plans. In such a plan the wireless telephone user would pay progressively higher calling rates as the distance (measured in number of zones) from a predetermined home zone increases. This zone based progressive rate plan is analogous to the billing practice used by Public Switched Telephone Network (PSTN) service providers. However, unlike the case of the PSTN where the call rate is based on the zone of the called number, the rate of a call from a zone based wireless telephone is based on the zone in which the wireless telephone is originating the call.

One problem experienced by wireless telephone users that Public Switched Telephone Network (PSTN) phone users don't experience derives from the mobility of the wireless phone. The mobility of the wireless phone makes critical the real time determination of the zone location of the wireless phone. When a wireless phone initiates a call, and as the call continues, the zone in which the wireless phone resides must be determined. The wireless phone may move from zone to zone during the course of a single call.

A possible solution requires the wireless phone to register with the system each time the phone crosses a zone boundary. In response to the phone registration message the base station responds with a message to the registering phone telling it what zone it is in. Every wireless phone system, regardless of modulation type, has some provision for mobile phone registration. The Code Division Multiple Access (CDMA) cellular system interface is specified in Telecommunications Industry Association (TIA) and Electronic Industries Association (EIA) interim standard TIA/EIA/IS-95

MOBILE STATION-BASE STATION COMPATIBILITY STANDARD FOR DUAL-MODE SPREAD SPECTRUM SYSTEMS.

As defined in TIA/EIA/IS-95 a CDMA cellular phone has multiple registration modes. The standard defines nine different registration methods supported in a CDMA system. The different forms of registration are Power Up, Power Down, Timer Based, Distance Based, Zone Based, Ordered, Traffic Channel, Parameter Change, and Implicit.

In a CDMA system each base station periodically sends overhead messages on a Paging Channel to any phone within its coverage area. The overhead information is sent to the phones as a System Parameters Message and includes System Identification (SID) numbers and Network Identification (NID) numbers. From these two numbers a phone can determine whether or not it is within the coverage of its home system. A phone not in the home coverage area is considered to be roaming. The phone displays the roaming status to the user since charges incurred for roaming phone calls are typically higher than for the same phone call made from a home system.

Additionally, the System Parameters Message includes a data field for a Registration Zone. The Registration Zone in conjunction with the SID and NID numbers can trigger a mobile phone zone based registration. The phone stores a list of zones, ZONE_LIST, in which it has registered. The number of zones stored in ZONE_LIST is a variable that can be set by a data field in the System Parameters Message. The phone compares the SID, NID, and Registration Zone information received in the System Parameters Message with the entries in the ZONE_LIST. If the SID, NID, and Registration Zone information is not already stored in the ZONE_LIST the phone initiates a registration on the Access Channel.

The ZONE_LIST is kept current by initiating a zone list timer for every entry in the ZONE_LIST. When the timer expires for any particular entry in the ZONE_LIST the entry is removed from the list. Similarly, if the information received in the Systems Parameter Message indicate a new zone and the maximum number of zones already exists in the ZONE_LIST

the phone will use the zone list timers to determine the oldest entry and delete it from the list.

Zone based registration is particularly useful in maximizing the capacity of the Paging Channels. A paging message can be directed to a phone using only those base stations in which the phone has recently registered. This maximizes system resources by eliminating the need to broadcast the paging message across all base stations just to ensure a single user receives the paging message.

General zone based registration can be modified to allow zone information to be transmitted to the phone whenever the phone enters a zone. In order to accomplish this the system needs to be configured such that the number of entries maintained in the ZONE_LIST is limited to one. This ensures the phone initiates a registration message whenever it crosses a zone boundary. In response to the phone registration the base station sends a directed message to the registering phone informing the user of the zone status. This directed message would be a text message to be displayed to the user. The user would then always know the current zone status and would presumably know what the corresponding billing rate is in that zone.

However, there are numerous disadvantages with configuring a system in this way. Since the number of entries in the phone ZONE_LIST is reduced to one the number of times a phone has to register in a system will increase. The increase in the number of registration messages sent by the phone is most evident when the phone is operating in a border region between two zones. When the phone is operating in a border region it will likely cross between the coverage area of the two zones numerous times. Since the number of entries in the ZONE_LIST is restricted to one the phone is required to transmit a registration message each time the phone receives a System Parameters Message indicating a different zone. The effect is to greatly increase the number of times the phone is required to transmit a registration message. The increase in the number of transmitted registration messages results in a depletion of the battery energy in the phone thereby reducing the available standby and talk times of the phone. Many phones continually sending registration messages have the effect of

over burdening the Access Channel. Where the zone boundaries occur on a major thoroughfare there is the problem of a large number of phones overloading the Access Channel with effectively simultaneous registration messages.

Additionally, each registration message triggers a complementary directed message informing the registering phone of the zone. The directed messages, by their very definition, are sent to individual phones. The number of directed messages is greatly increased with the current planned method of informing phone users of zone information. This results in a loss of capacity on the Paging Channels.

The loss in Access Channel and Paging Channel capacity is not balanced by the user benefit of knowing which zone they are currently in. Furthermore, if the zone based progressive rate plan is only used by a small minority of subscribers supported by the service provider the system and a majority of subscribers are heavily penalized to benefit a small group of users. Each phone user has less phone talk time and standby time because of the increased number of registration messages required of the phone, yet the complementary received zone information is helpful only to a small number of progressive rate plan subscribers.

What is required is a system and method of notifying those users on the progressive rate calling plan of the zone information without penalizing the wireless system or the users not on the same calling plan.

SUMMARY OF THE INVENTION

The present invention is a novel and improved system and method for notifying users of zone information using broadcast addressed feature notification messages. Alternatively, the user can be informed of zone information using Short Message Services (SMS) messages.

A base station periodically transmits broadcast addressed feature notification or SMS messages containing a text message that informs the user of the zone that the base station is within. Phones that are on a zone based progressive rate plan are assigned specific broadcast addresses. All

other phones using other calling plans are not assigned the same broadcast address. The phones with the broadcast address are able to determine that the addressed information is directed to that phone. Phones without the broadcast address merely discard the message. Therefore, phones on the progressive rate plan are able to continually update the zone information to the user. There is no detrimental effect to those phones not subscribed to the progressive rate plan. System capacity on the Access Channel is maintained since there are no registration messages required of the phones in reply to the zone information messages. The capacity on the Paging Channel is only decreased by a nominal amount and is decreased nowhere near the level when directed messaging is used. The use of broadcast messaging is much more efficient than directed messages since broadcast messaging allows a single transmission to be directed to many phones while directed messaging only allows one recipient for each transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

The features, objects, and advantages of the present invention will become more apparent from the detailed description set forth below when taken in conjunction with the drawings in which like reference characters identify correspondingly throughout and wherein:

FIG. 1 is a drawing depicting a system implementation of the invention and showing varying zone boundaries and effects on users traveling in a border area; and

FIG. 2 is a flow chart illustrating the zone notification method.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In a CDMA wireless phone system operating in accordance with TIA/EIA/IS-95 there are several messaging formats that can be used to send information from a base station to phones. Two such available messaging formats are Feature Notification Messages and Short Message Services (SMS).

Feature Notification Messages are sent from the base station to the phone on the Paging Channel. One of the fields in the Feature Notification Message allows the message to utilize broadcast addressing.

Broadcast addressing allows the base station to simultaneously direct a single message to many phones. Many phones can share the same broadcast address. Provided the phone is configured to receive broadcast addressed messages and is configured with the particular broadcast address the phone will process the message. This is in contrast to directed messages that the base station sends to a particular phone using a phone Mobile Station Identification number.

The use of broadcast addressing is advantageous because one message can be directed to many recipients and because messages can be directed only to those individuals for which the message provides useful information. In the case of zone based progressive rate billing those phones on the rate plan are assigned a particular broadcast address that are not included in any phone not on the rate plan. Only those phones on the progressive rate plan will process zone identification messages transmitted using broadcast addressing. This is in contrast to the method requiring a phone to register each time it crosses a zone boundary. Phone registration cannot be configured differently among phones within the same system. If all phones are required to register whenever a zone boundary is crossed, the wireless system suffers a significant reduction in capacity to provide a benefit for a small percentage of total subscribers.

The benefit provided to the subscribers of a progressive rate plan is information identifying the zone the phone is in. In addition to utilizing broadcast addressing to direct the message, the Feature Notification Message can be configured to provide a "display" record. The use of a "display" record indicates to the phone that the contents of the Feature Notification Message are alphanumeric characters to be displayed on the phone. The particular alphanumeric message each base station transmits is the zone information (e.g. "You are in zone 3." or "Welcome to downtown" or "City Mall" etc:) The user is then able to determine whether a phone call initiated from that particular zone would incur an increased charge. By periodically

transmitting the Feature Notification Message any phone entering the zone is notified of a change in zone status. No transmit activity is required of the phone. Furthermore, since broadcast addressing is used, only those phones for which the message is intended will process and display the message.

Short Message Services (SMS) messages can be used as an alternative to Feature Notification Messages. SMS messages are primarily used to communicate alphanumeric information to wireless phones. The general specification for SMS in a CDMA phone system can be found in Telecommunications Industry Association and Electronic Industries Association specification TIA/EIA/IS-637, SHORT MESSAGE SERVICES FOR WIDEBAND SPREAD SPECTRUM CELLULAR SYSTEMS. Messages may be initiated at a message center and transmitted via the base station to the phone. Messages may also be initiated at the phone and transmitted to the message center through the base station. Here the only concern is the periodic transmission of zone information from the base station to the phone.

Messages transmitted from the base station to the phone may be transmitted over the Paging or Traffic channels. The messages transmitted to the phone are formatted as Data Burst Messages as defined in TIA/EIA/IS-95. As in the case of Feature Notification Messages, messages may either be sent to individual phones as point-to-point directed messages or may be simultaneously sent to many phones as broadcast messages.

Operation of the invention is illustrated in FIG. 1. Referring to FIG. 1 a portion of a wireless system **100** is shown. A first base station **110** provides coverage on one side of a zone boundary **130**. A second base station **120** provides coverage on the opposite side of the zone boundary **130**. The numerous elements comprising each base station, **110** or **120**, are not critical to this illustration so are assumed to be embodied within the figure representing each base station, **110** and **120**.

The zone boundary **130** is depicted as a randomly varying curve to highlight the inability to define discrete zone boundaries. Although a zone boundary **130** may be distinctly defined in a system design, the actual zone boundary **130** varies due to numerous factors including terrain, RF

obstructions, and antenna patterns. A user **140** operating a mobile phone **141** within the service area of the wireless system **100** will be in communication with at least one base station, **110** or **120**, at any given time.

When the mobile phone **141** moves through a boundary area between zones the coverage will alternate between a first base station **110** and a second base station **120**. For a given path **142** along the boundary area the mobile phone **141** will cross the zone boundary **130** a number of times. When the mobile phone **141** is in the coverage area defined by the first base station **110** both forward link **114** information and reverse link **112** information will be supported by the first base station **110**. Similarly, when the mobile phone **141** is in the coverage area defined by the second base station **120** the corresponding forward link **124** and reverse link **122** channels are supported by the second base station **120**.

Under an existing embodiment the mobile phone's **141** zone location is updated by requiring the mobile phone **141** to register each time a zone boundary **130** is crossed. Each time the mobile phone **141** crosses the zone boundary **130** the System Parameters Message received at the mobile phone **141** will originate from a different base station. Taking the situation illustrated in FIG. 1, the mobile phone **141** initially is operating in the coverage area defined by the first base station **110**. The System Parameters Message broadcast from the first base station **110** identifies the zone that the first base station **110** is within. Upon first entering the zone and receiving the Systems Parameter Message on the forward link **114** Paging Channel the mobile phone **141** sends a registration message on the reverse link **112** Access Channel to the first base station **110**. The first base station **110** responds by sending, on the Paging Channel, a directed message containing zone information to the mobile phone **141**. As the mobile phone **141** travels along a path **142** in a border region it crosses the zone boundary **130**. Once the mobile phone **141** crosses the zone boundary **130** the coverage is now provided by a second base station **120**. The second base station **120** sends out a System Parameters Message indicating a different zone. In response to the indication of a zone different from the one the mobile phone **141** is already registered in, the mobile phone initiates another registration message on the

reverse link 122 Access Channel to the second base station 120. In return, the second base station 120 sends a directed message containing zone information to the mobile phone 141. This scenario of a System Parameters Message indication of a change of zones followed by mobile phone 141 registration and base station transmission of a directed message is repeated each time the mobile phone 141 crosses the zone boundary 130. When the registration scenario is multiplied by the number of phones crossing a zone boundary at any given time, it can be seen that the load presented to the wireless system is considerable.

Additional mobile phones 150 and 160 operating along the zone boundary 130 will traverse independent paths 152 and 162 respectively. As the mobile phone 150 traverses path 152 it will cross the zone boundary 130 two times and will be required to register each time it crosses the boundary 130. The mobile phone 150 will receive zone information in response to each registration. Likewise, a third mobile phone 160 traversing along an independent path 162 will be required to initiate registration messages and will receive zone information replies each time it crosses the zone boundary 130. The constant registration messages from the mobile phones 141 decrease the capacity of the Access Channel while the numerous directed messages from the base stations, 110 or 120, reduce the capacity of the Paging Channel.

Revisiting the conditions of FIG. 1 with the present invention implemented in the system, it can be seen that the present invention requires no transmissions from the mobile phone 141. Instead, each base station, 110 or 120, periodically transmits a broadcast addressed Feature Notification Message or SMS message containing a display record with the zone information. The period that the base station 110 or 120 repeats the Feature Notification Message is determined at system design and is typically in the range of 5 - 15 seconds. When the mobile phone 141 is in a particular zone it receives and processes the Feature Notification Message and displays the zone information to the user. As the mobile phone 141 proceeds along a path 142 on a boundary between zones the mobile phone 141 alternately receives a Feature Notification Message from either the first base station 110

or the second base station **120**. The Feature Notification Message the mobile phone **141** receives and processes corresponds to the zone in which it currently resides. The mobile phone **141** is not required to make any active transmissions in order to be notified of the current zone. This reduces the load on the Access Channels and conserves battery power within the phone. Additionally, since the base stations **110** and **120** are able to use broadcast addressed messages instead of directed messages the load on the Paging Channels is reduced. It can be seen that additional mobile phones **150** and **160** operating in the zone boundary provide no increased load on the system. Each base station **110** or **120** transmits a zone notification message independent of the number of mobile phones **141, 150,** and **160** crossing the zone boundary **130**. Each mobile phone **141, 150,** and **160** displays the zone notification message corresponding to the base station **110** or **120** providing the zone coverage.

The zone notification method is summarized in FIG. 2. After starting **200** the method the zone notification message is transmitted from the base station **204**. The base station does not transmit the zone notification message in response to an event, rather the transmission of the message is the sole zone notification activity required of the base station. The base station configures the message as a broadcast addressed message to simultaneously direct the message to multiple phones. At decision step **208**, the limitations of the base station coverage area effectively allow the routine to proceed only if a phone is within the coverage area. No device actually performs the decision, rather the decision is made by the physical coverage limitations. If a phone is not within the coverage area of the transmitting base station the transmitted signal will be too weak to be received by any phone. Therefore the routine ends **240**. If there is a phone within the coverage area the phone receives the zone notification message **210**. At decision step **220** the phone checks to see if the message was directed to that phone. This check is done by comparing the broadcast address of the zone notification message against predetermined addresses saved within the phone. If the broadcast address is not one saved within the phone, the phone determines that the message was not directed to it. Therefore the

phone discards the message 230 and the routine ends 240. However, if the broadcast address coincides with an address saved within the phone, the phone processes the message 224 and displays the text component of the message to the user 228. If the method of FIG. 2 is repeated on a periodic basis each phone within the coverage area of the base station will be continually updated with the correct zone information.

The previous description of the preferred embodiments is provided to enable any person skilled in the art to make or use the present invention. The various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without the use of the inventive faculty. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

What is claimed is:

CLAIMS

1. A wireless communication system used to inform users of presence within a predetermined zone comprising:

a plurality of base stations defining a plurality of predetermined zones, each zone comprised of one or more base stations; and

a plurality of mobile units capable of traveling between the predetermined zones;

wherein each base station transmits a zone information message corresponding to the predetermined zone in which the base station resides and wherein each mobile unit provides a user indication of zone presence by receiving and processing the zone information message from the base station with which the mobile unit is currently in communication.

2. The wireless communication system of Claim 1 wherein each base station periodically transmits the zone information message.

3. The wireless communication system of Claim 1 wherein the zone information message is a Feature Notification Message.

4. The wireless communication system of Claim 3 wherein the Feature Notification Message uses broadcast addressing and a display record type.

5. The wireless communication system of Claim 4 wherein the user indication of zone presence is the contents of the Feature Notification Message display record.

6. The wireless communication system of Claim 1 wherein the zone information message is a Short Message Services (SMS) message.

7. A method for informing a plurality of wireless phone users of presence within a predetermined zone comprising the steps:

transmitting from a base station a zone information message;

receiving at the wireless phone the zone information message;

processing the zone information message within the wireless phone; and

indicating to the wireless phone user a zone presence corresponding to contents of the zone information message.

8. The method of Claim 7 wherein the steps are repeated periodically.

9. The method of Claim 7 wherein the zone information message is a Feature Notification Message.

10. The method of Claim 9 wherein the Feature Notification Message is broadcast addressed.

11. The method of Claim 10 wherein the Feature Notification Message defines a display record type.

12. The method of Claim 11 wherein the indicating step is performed only if the wireless phone has the same broadcast address as used in the Feature Notification Message.

13. The method of Claim 7 wherein the zone information message is a Short Message Services (SMS) message.

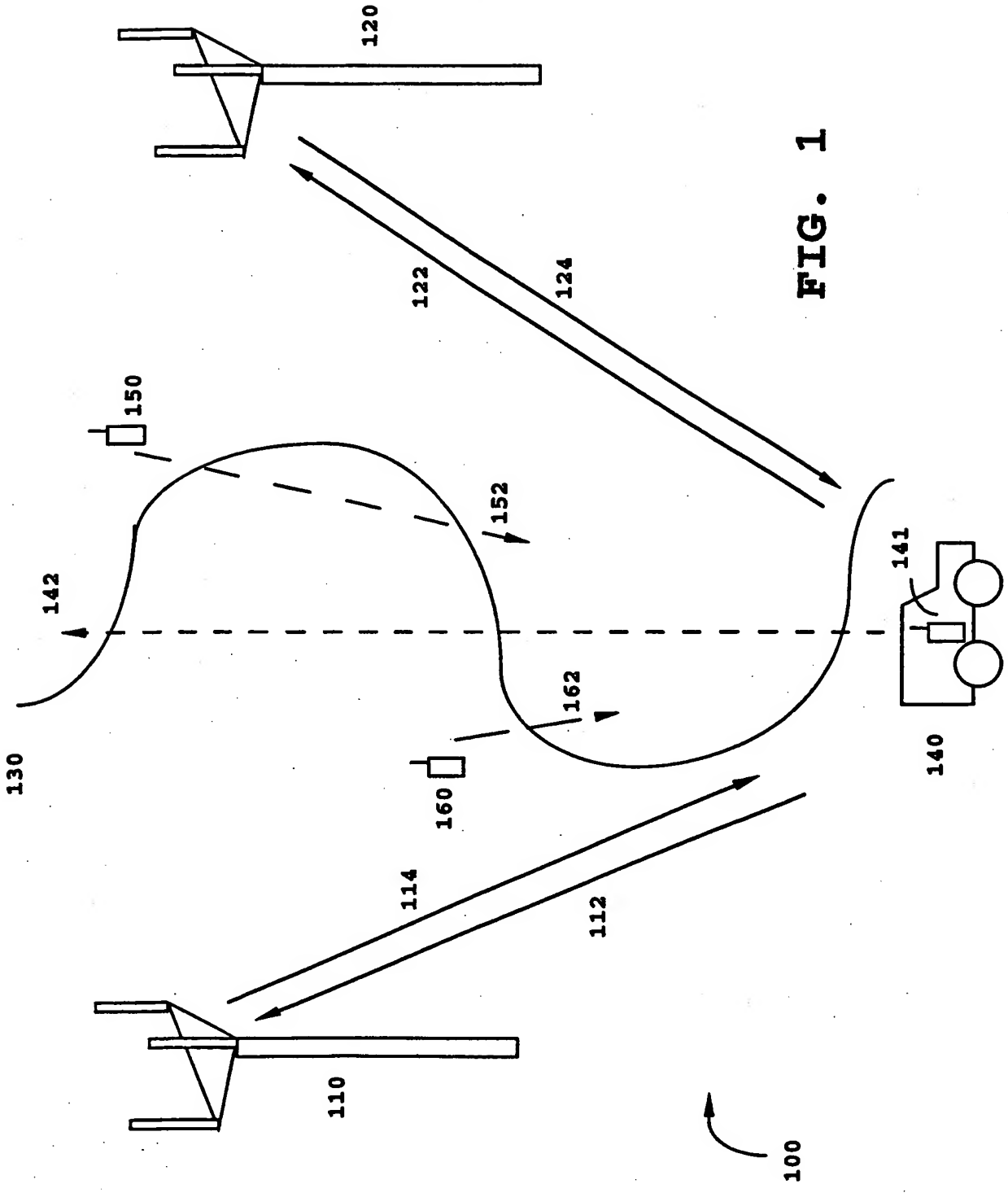

FIG. 1

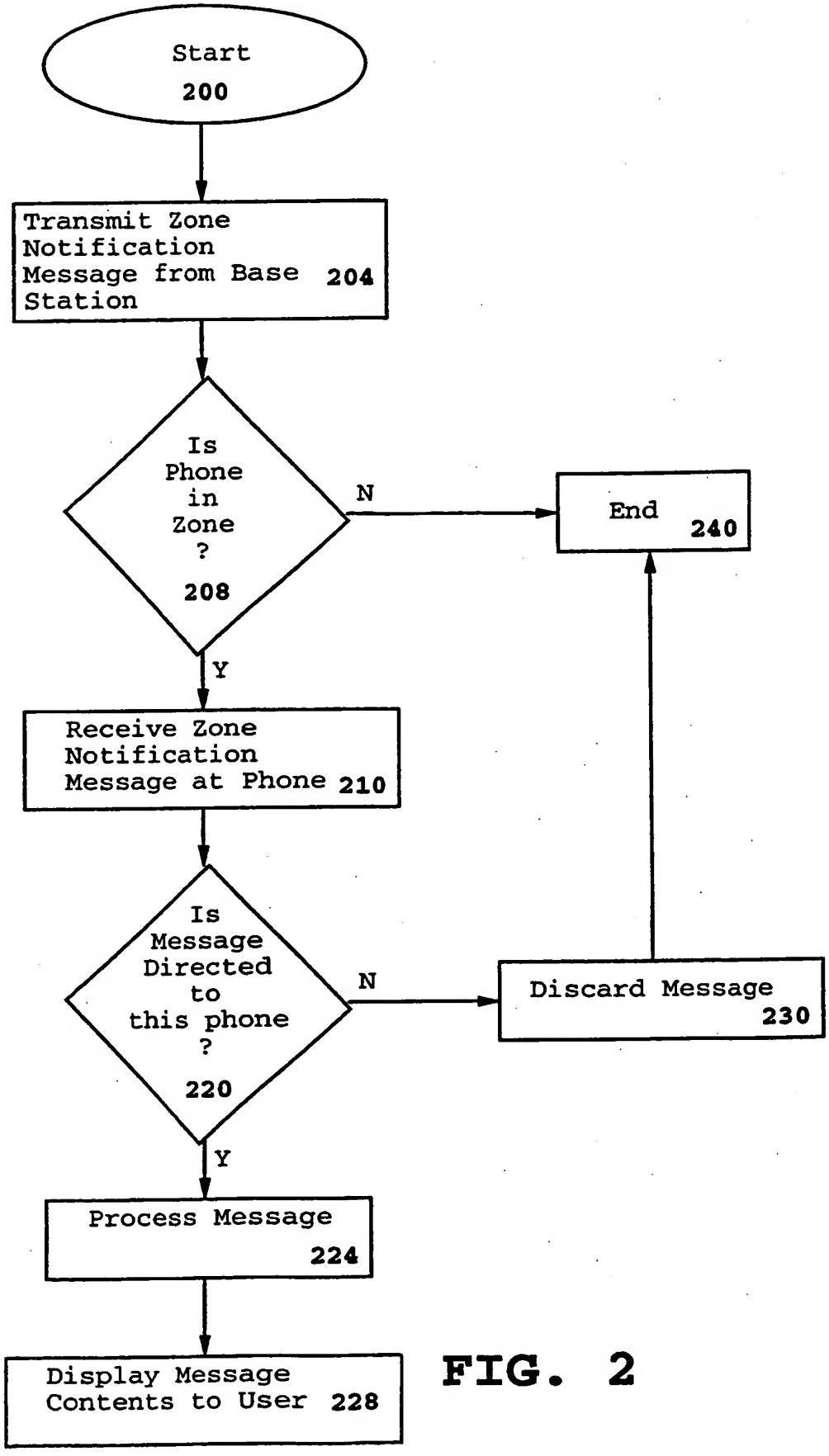
Start
200
Transmit Zone Notification Message from Base Station 204
Is Phone in Zone ? 208
N
End 240
Y
Receive Zone Notification Message at Phone 210
Is Message Directed to this phone ? 220
N
Discard Message 230
Y
Process Message 224
Display Message Contents to User 228

FIG. 2

INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/US 00/22730

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
PAJ, EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 42151 A (ERICSSON GE MOBILE INC) 24 September 1998 (1998-09-24) page 6, line 30 -page 7, line 19	1-13
X	CA 2 195 487 A (AT & T WIRELESS SERVICES INC) 21 August 1997 (1997-08-21) page 3, line 3 - line 23 page 4, line 9 - line 18 page 6, line 1 - line 21 page 12, line 12 - line 18 page 15, line 4 - line 14 page 23, line 28 -page 25, line 15	1,2,6,7, 13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
14 November 2000	24/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Rothlübbers, C

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte onal Application No
PCT/US 00/22730

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